

Moving Along the Straight and Narrow ... You Be Tripping or Dat's How'z Uz Roll'z

Purpose:

1. To design and build a racecar that will run farther, faster and straighter than any other in class.
2. To learn more about position, velocity, and acceleration as an introduction to our unit on mechanics.

Rules o' the game are.....

1. The car must be all hand assembled and have at least **THREE** working wheels and a **frame**. The wheels must be round and be able to turn separate from the frame; they must touch the ground for the car's entire trip, although they do not have to turn. (No Coffee can cars...)
2. The car must start under its own power and run only on the flat surface of the floor.
3. If a catapult or incline plane is used; the race begins when the car touches the floor.
4. If using an incline plane, the car must first be propelled from the floor up the plane without interruption.
5. Trigger devices (e.g.; releasing a balloon) are acceptable IF they are permanently attached to the car AND require only the movement of a single switch or release to activate.
6. No electrical, *animal*, or commercially available motors.
7. No prefabricated wheels; cannot be a "kit" car (like from Boy Scouts) or K'NEX, wheels from other toys. **Can't use something that is designed as a wheel.**
8. No tracks, guidewires, or strings used to maintain a straight path.
9. No CO₂ or NO₂ cartridges or any rockets, combustion or any potentially dangerous vehicle that could jeopardize the safety of any student, teacher, or administrator (well, maybe an administrator) are allowed - if there's a question - ask!
10. The car must move as a whole unit, not part of the car being immobile and part being mobile, i.e. no rubber band launchers.
11. Two to four engineers per group. Each person needs to help with lab write-up/website. Format for lab write-ups is on the back of this handout. If more than 4 engineers are used then for each person over 4 the group has a new differently designed car must be made, and **group will be graded on the lowest performing car with no opportunity to earn bonus points, if no extra car the group grade will be a ZERO.** 5 engineers = 2 cars; 6 = 3 cars; 7 = 4 cars; ect. ***If only 1 person is in group then NO BONUS POINTS can be earned and a 0 / 10 points will be the grade for the group grade part and they must build 2 cars and be graded on the lowest performing car.***

GRADING FOR "Race Car Physics"

- 1) 10 points just for entering ON TIME - Sorry, no excuses.
- 2) 10 points if the racecar moves 1 car length.
- 3) **1 additional points for every ceramic tile (foot) moved beyond one car length.** (*Max of 30 bonus points possible*)
- 4) Fastest car over 5 feet (5 blocks)

20.0 pts	19 pts	18 pts	17 pts	16 pts	15 pts
fastest car	next fastest car	third fastest car	fourth fastest	fifth fastest	sixth and so on
- 5) **Zee 'greatest and straightest' distance***. Specifically, the object is to maximize the value of **Z**, where **Z = [D - 3E]**. **D is the distance traveled in feet, E is the lateral movement from the centerline.**

20.0 pts	19 pts	18 pts	17 pts	16 pts	15 pts
greatest Z	next highest Z	third Z	fourth Z	fifth Z and so on
- 6) (Mass)(speed) product as measured from start until car stops. (This is also known as momentum)

20.0 pts	19 pts	18 pts	17 pts	16 pts	15 pts
Largest product	second	third	fourth	fifth	and so on
- 7) Creativity. Hard to measure, we will come up with criteria in class.

20.0 pts	19 pts	18 pts	17 pts	16 pts	15 pts
First	second	third	fourth	fifth	and so on
- 8) Lab write-up (**WEBSITE**) (**TYPED UP**). Up to 30% total. (purpose; set-up, data, and calculations; analysis; Things that should be included → Pictures / Movies of different stages of lab, Works Cited).

9) **Group analysis (Done individually)– 10 points. Type up an explanation that grades how each person contributed to the group (Divide the 10 points among group members, explain why they get the grade they get. If 1 person builds the car they should receive more points than the other group members.) If there is no explanation of why the points are split the way they are then the grade will be a 0/10 points.**

Lab write-up format is described later in this handout.

Make sure you include your data, sample calculations, and use units (acceleration might be in feet per second per second).

Thus..... this project is will be graded out of 200 possible points. Note that it is possible to score higher than this.... but there will be a 30 point 'cap' to the bonus points you can earn.

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Lab write up (WEBSITE) format. Please make sure to title each page of the website and write your name and date on each webpage.

1. Purpose:
 - Put in your OWN words!! The intended purpose will not always be the same as what is in the lab(s). This should be to the point.
2. Set Up:
 - Use drawings/schematics to aid in making your procedures brief. "Synthesize" elements from the lab and make sure another group could understand well enough to repeat what you do. You need to take pictures of the car at each step in the build and record movies of the trial runs.
3. Data:
 - Use tables and movies. Label the measurements and what units you used thoroughly.
4. Pictures and Movies:
 - Take multiple pictures and video of the build progress and testing of your car.
5. Calculations:
 - Use three steps. A) Formula
B) Actual data replacing the variables
C) The answers with correct units
6. Analysis and Results:
 - Write a brief conclusion based on your findings. Be sure to include relationships and references to your data and calculations. You may want to include reasons for experimental error, possible improvements to the experiment, etc. here. The *analysis* of what went right, what went wrong, and how your lab could be improved are important. The amount of analysis is the most important part of your lab write-up.

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Data to record for lab write-up:

At a minimum you should be recording the following data: Car **mass** (in g), **Total distance** (D), **Lateral movement** (E), **Time** (0 to 5 feet- if car goes that far), **The average velocity for 5 ft**, **Time** until car stops, **distance** car traveled, and **average velocity** of for entire trip. **(Mass)(Speed)** product in (gram)(feet)/sec.-----> Very funky and non-Physics-like units, but OK for now... and finally find **“Z value” (straight line distance) = [D - 3E]. Not a bad idea to record other data! Make sure you film the test trials done outside of school.**

* NOTE* If the car does not go 5 feet, determine the average velocity until the car comes to a stop.